

I. Introduction

September, 1991 marks the beginning of the third year of work by the Galveston Bay National Estuary Program toward creation of a Comprehensive Conservation and Management Plan for the estuary. In pursuit of this goal, the GBNEP has become firmly established, well known throughout the Galveston Bay Community, and has elicited a high commitment level from resource agencies and user groups.

The main thrust of program activities during the preceding year has been to characterize the estuary's problems--problems recognized by consensus early in the program and enumerated in the "Galveston Bay Priority Problems List". (See Table 1) In the coming year, emphasis will shift toward management solutions to these problems. This shift in emphasis will involve additional scientific work to determine probable causes of problems, as well as continuation of key characterization studies.

Increasingly in the coming year, the governance of Galveston Bay will be an issue before the GBNEP. A major project to evaluate current estuary management will be initiated, with findings to eventually play a major role in drafting of the CCMP. Scientific issues and issues of governance fit together, as described by several key anticipated milestones for the GBNEP. These milestones, for which work in the coming year will be critical, are:

- 1. Galveston Bay Environmental Characterization Report.** This report is to be a summary of ecological and technical findings from the Galveston Bay characterization effort. The report is to be written for managers, decision-makers and scientists, but in plain English to the greatest extent possible. The report is written in an ecosystem management context, with the primary goal of conveying complete information about the Priority Problems and related environmental status and trends. The report will be drafted by program staff, with possible contract help. Target publication date: February, 1993.
- 2. Framework For Action: The Governance of Galveston Bay.** This report is to be a summary of management evaluation findings, based on the Bay-wide Regulatory Survey and Regulatory Evaluation projects, and including lessons learned from the Coastal Preserves management studies. The report will contain findings and policy analyses concerning Bay jurisdictions and management efforts, including gaps, overlaps, and weaknesses of the current regulatory system. The report will be drafted by the Principal Investigator of the Bay-wide Regulatory Evaluation Project, and will include recommendations that will contribute to drafting of the CCMP. Target publication date: February, 1993.
- 3. The State of the Bay Publication.** This is a public document for wide distribution. Contents will combine summaries of the ecological and regulatory findings of the two preceding reports, with the primary goal of highlighting Galveston Bay's problems and defining the need for a CCMP. The publication will be written

Table 1.
Galveston Bay Priority Problems List

Within the List, the four major problems (identified by letters A-D) are ranked in order of importance and are considered to be clearly independent. The second order problems within each major problem (identified by number) area are interdependent and may contribute or interact with problems of equal or higher category.

A. REDUCTION/ALTERATION OF LIVING RESOURCES

1. Loss of Physical Habitat
 - * wetlands and sea grasses
 - * oyster reefs
 - * shallow bay bottom (unvegetated)
2. Alteration of Salinity Gradients
 - * impoundment, diversion, and interbasin transfer of fresh water inflow
 - * bathymetric and circulatory changes (salinity intrusion)
 - * ungaged inflows from rainfall in coastal watersheds
3. Alteration of Nutrient and Organic Loading
 - * eutrophication and hypoxia
 - * point and nonpoint sources
4. Bathymetric and Circulatory Changes
5. Land Subsidence and Sea Level Rise
6. Chemical and Pathogenic Contamination (biotic impairment)
 - * point and nonpoint sources
7. Increased Turbidity and Sedimentation

B. PUBLIC HEALTH ISSUES

1. Discharge of Pathogens to Bay Waters
 - * point and non-point sources
2. Chemical Contamination of Water, Sediments, and Living Organisms
 - * point and nonpoint sources
3. Restriction of Contact Recreation
 - * chemical and pathogenic contamination

C. RESOURCE MANAGEMENT ISSUES

1. Regulatory Problems
2. Fish and Wildlife Resource Depletion
3. Marine Debris
4. Public Access to Resources

D. SHORELINE EROSION

1. Land Subsidence and Seal Level Rise
2. Bathymetric and Circulatory Change
3. Loss of Buffer Vegetation (Wetlands)
4. Use of Littoral Property

by the program staff in plain English, will be well illustrated, and will be designed to help the public learn more about the Bay and its problems, and to better appreciate the need for improved management. Target publication date: June, 1993.

4. Comprehensive Conservation and Management Plan. The management plan is to be a series of simplified action plans of no more than several pages each (with detailed supplemental information included as appendices). Each action plan describes a problem, and answers "who, what, when, where, why, and how much" questions in a direct way. These action plans are designed for politicians, managers, and the public to easily understand. The CCMP will have implementation and funding strategies associated with recommended actions. Target publication date: September, 1994.

Work by the GBNEP to reach these milestones will continue to utilize the consensus-building approach that has become a hallmark of the National Estuary Program. The work will not be guided only by scientists and environmental managers; anyone with an interest in Galveston Bay can be part of the program. Industry, shipping, business, development, fishing, environmental, and community interests are active partners in all ongoing efforts of the program. Comments, questions and suggestions about this work are welcomed at the Program Office at any time.

Review of Fiscal Year 1991

The EPA/State Management Conference Agreement (Publication GBNEP-1, available from the Program Office) outlines the five years of work leading to creation of a CCMP in 1994. The commitments made in that agreement were structured to provide a long-term flexible planning framework for individual annual work plans like this one. This Annual Work Plan therefore strives to be consistent with the Management Conference Agreement, while at the same recognizing new and better approaches not identified when the Management Conference Agreement was drafted.

Identification and Ranking of Priority Problems

Creation of the Priority Problems List was accomplished ahead of schedule and in accordance with the Management Conference Agreement, as described in the FY 1991 Annual Work Plan (Publication GBNEP-5). The Priority Problems List continues as an extremely useful guide for the GBNEP. The list has continued to help identify and scope projects and eliminate approaches which will not directly contribute to the CCMP.

One challenge noted in the original creation of the Priority Problems List was the difficulty of summarizing the complex problems of the estuary in an ecosystem context. In effect, the linear nature of the list did not lend itself completely to defining ecosystem impacts occurring in multiple dimensions in time and space. The complex relationships present in Galveston Bay and the insight needed for identification and solution of the problems required additional work.

Figure 1.

Galveston Bay Impact Matrix

Revised 8/21/91

Valued Ecosystem Components

Sources of Perturbation	Water Quality	Circulation	Sediment	Phytoplankton	Zooplankton	Oysters	Shellfish	Other Benthos	Finfish	Birds	Marine Mammals	Sea Turtles	Human Health	Wetlands	Submerged Plants	Shoreline	Aesthetic Appeal
Northers		**		?	?	*			**								
Hurricanes		**	*	?	?		*	**		*			?	?	***	***	
Inflow Modification	***	***	*	?	?	****	***	**	***			?		***	**		
Subsidence/Sea Level		**				*				*				****	***	***	
Shoreline Development	**	*	*						*	*				****	**	****	***
Dredging	***	***	***			**	**	**	*	***	?	?	?	**	**	***	**
Shipping	**		*								?					*	
Point Sources	****		****	**	**	***	**	**	**	**	?	?	****	*	**		**
Non-Point Sources	****		****	?	?	***	**	?	**	**	?	?	?	**	**		**
Commercial Fishing	?		?			***	****	?	***		?	?			*		
Recreational Fishing						*	*		***					?	*		
Boating/Marinas	**		**	?	?			*	*					*	*	*	?
Petroleum Activity	***		**	?	?	*	*	**		*	?	?		**	*		?
Oil/Chemical Spills	***		***	?	?	**	?	?	?	**	?	?	**	***	?		***
Marine Debris									?	*	*	**					***

* = slight influence
 ** = moderate influence
 *** = significant influence
 **** = major influence
 ? = unknown relationship
 [shaded box] = management priority

Therefore, two additional efforts were undertaken which, in concept, are extensions of the Priority Problems List. The first is an Ecosystem Impact Matrix (Figure 1). This approach expands the problems to two dimensions, with individual cells of the matrix suggesting impacts with both scientific and management implications (Managing Troubled Waters: the Role of Marine Environmental Monitoring, National Research Council, 1990). Knowledge gaps become quite evident with this approach (the question marks in the matrix). The matrix suggests what problems require attention, but gives little indication where they occur or how they can be solved.

The second effort is creation of an ecosystem conceptual model, fully described below as a scientific project for the coming year. The conceptual model will become a paradigm for determining both ecosystem function and human interference with key ecosystem processes. While significantly more complex than a list or matrix, the model will allow descriptions of complex processes that occur in time and space at the ecosystem level. The multiple-tier approach will allow use by the public, as well as by scientists and managers.

Program Inventory

As described by the Management Conference Agreement, the Program Inventory had a two-fold purpose: identification of existing agency data sets related to Galveston Bay, and compilation of existing management jurisdictions and activities by governmental agencies. The GBNEP determined that these purposes were best accomplished by separate projects: a Data Base Inventory and a Bay-wide Regulatory Survey.

The **Data Base Inventory** contains complete descriptions and specifications for existing bay-related data sets. The inventory consists of an electronic-searchable data base of data set descriptions, including access information. This project provides an invaluable tool for future work of the program, and the principal investigators have gone beyond the requirements of the project to track down and acquire the data when it can be found. During this process a major problem was identified. For various reasons (detailed in: Proceedings. Galveston Bay Characterization Workshop, February 21-23, 1991, publication GBNEP-6) up to eighty percent of the historical data is missing and presumed permanently lost. This problem has implications for future data and information management, particularly the future commitment to archiving.

The **Coastal Preserves Regulatory Survey** and the **Coastal Preserves Regulatory Evaluation** identified, described, and evaluated all management jurisdictions and activities within the Christmas Bay and Armand Bayou Coastal Preserves. These activities have prepared the way for the **Bay-wide Regulatory Survey**, now being conducted, and the **Bay-wide Regulatory Evaluation**, an FY 1992 project. Evaluations of agency management are to be linked to the simple base program descriptions specified by the Management Conference Agreement for this element, and state and local entities are to be included in addition to the federal programs required by EPA guidance. Results of all above projects excepting the Bay-wide Regulatory Evaluation are either complete, or are scheduled for completion by August 31, 1991.

Base Programs and "Action Now" Implementation

The Management Conference Agreement specifies an evaluation of existing agency management activities. This evaluation was then to be the basis for improvements recommended in a "Base Programs Action Plan" in July of 1991 prior to the CCMP.

The current approach accomplishes these objectives within the framework of the activities summarized above. The **Coastal Preserve Regulatory Evaluations** lead to **Coastal Preserves Management Plans** by Fall, 1991, that specify changes in regulatory activities to better protect and enhance these two subsystems of Galveston Bay. The Management Plans will be approved prior to a CCMP as an early model to be used in similar efforts for work on the bay-wide scale. The Regulatory Evaluations and Management Plans for coastal preserves will be steps toward fulfillment of the requirements for a Base Programs Action Plan. This process will become complete with completion of the "Bay-Wide Management Evaluation" project.

In addition, the **Shoreline Survey for Point Sources** identified unregulated or illegal discharges to the Bay. These cases were submitted to appropriate agencies, and enforcement reports were received detailing actions taken to bring discharges into compliance.

Data and Information Management System (DIMS)

Although a DIMS was not specifically required by NEP guidance, such a system was deemed necessary by the Management Conference and was therefore included in the Management Conference Agreement. Commitments were made and carried out for identification of DIMS requirements, a feasibility study and report, and choice and implementation of the best DIMS alternative. The DIMS strategy incorporates centralized information but decentralized data processing. These elements were detailed in the FY 1991 Annual Work Plan.

The Galveston Bay Data Base Inventory, an FY 1990 project, is now functional as an electronic searchable data base of data set descriptions, containing sufficient information for program participants and project contractors to acquire relevant data from appropriate agencies. Other components of the DIMS Strategy include use of EPA's Ocean Data Evaluation System (ODES) for data formatting and archiving, use of the Texas Natural Resource Information System (TNRIS) as a data archive and distribution facility, and purchase of remote imagery of Galveston Bay taken in 1930. The GBNEP Convened a special DIMS meeting on January 15, 1991 to provide annual review and revision of the DIMS strategy.

The Galveston Bay Information Center was a specific funded project in FY 1991:

Galveston Bay Information Center

Funding:	\$100,000
Performing Organization:	Texas A&M University at Galveston
Principal Investigator:	Ms. Natalie Wiest
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	All; depends on topic

The Information Center was initiated in FY 1990 at Jack K. Williams Library on the Galveston Texas A&M Campus. Work in FY 1990 was primarily to compile a Galveston Bay Bibliography; work in FY 1991 emphasized continued entries in the Bibliography and acquisition of a special collection of published and unpublished agency reports, journal articles, maps, films, videos, slide programs, and aerial photos. The bibliography now contains more than 3000 citations and is on line at the Information Center (soon to be available by modem). Several major private collections have been donated to the Center, containing rare and unobtainable documents concerning the Bay. Establishment of the Information center, and opening the doors to the Galveston Bay user community, occurred in FY 1991. Although the Center is funded as a Scientific/Technical Project, and will be an on-line source of information for resource managers and the entire Galveston Bay community.

Accomplishments:

1. Collection building. This included acquisition, cataloging and classifying, and processing of materials to be added to the Information Center.
2. Building and maintaining a local area network (LAN) which is designed to link the Galveston Bay Bibliography, COMPAS, Galveston Bay Data Inventory, and the Aquatic Sciences and Fisheries Abstracts.
3. Provision of reference and information services for the Information Center.

Characterization of Historical Trends, Current Status, and Human Impacts on Galveston bay

The Management Conference Agreement specifies that characterization projects be tied to Priority Problems, that they address management needs, that they utilize existing data, and where gaps exist, that new data be gathered for specific purposes. These criteria continue to be used for selection and scoping of characterization projects.

Activities to achieve these goals in FY 1991 included initiation of additional specific projects, and convening of a major Galveston Bay Characterization Workshop. The Workshop was successful in accomplishing four purposes: 1) identification of scientific work being conducted by institutions other than the GBNEP; 2) promotion of peer interaction among all principal investigators involved in Galveston Bay research; 3) improvement in understanding of estuarine problems which suggest a need for improved management; and 4) encouragement of project

coordination in an ecosystem context. Fifty-six papers were submitted for the Workshop, of which fifty-one were verbally presented. All contributions were published in a proceedings.

Characterization projects initiated in FY 1991 or continued from FY 1990 include:

Trends and Status for Wetlands and Aquatic Habitats.

Funding:	\$151,000
Performing Organization:	University of Texas - Bureau of Economic Geology
Principal Investigator:	Dr. Jerry Wermund
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Reduction/Alteration Living Resources

This study, begun in FY 1990, involves mapping of shoreline and submerged aquatic vegetation (seagrass) habitats based on aerial photo interpretation and field verification. The work includes digitizing of maps for a computer geographic information system (GIS). Comparisons are made with previous maps from 1956 and 1979 to determine trends; further investigations determine causes for major trends/losses of critical habitat types. FY 1991 work under this project involved digitizing the newest (1989) photos, combined with field investigations to characterize habitat to a level of detail corresponding to plant species associations. The project will require additional work in fiscal year 1992.

Accomplishments:

1. Mapping, verifying, and digitizing 1989 Aerial Photographs. Aerial photographs were utilized to map apparent distinct habitat types. Maps were produced at an approximate scale of 1:24,000 which incorporate all habitat and feature determinations. Habitat categories mapped followed the USFWS National Wetland Inventory Classification system. Portions of the digitizing were delayed beyond the end of FY 1991.
2. Perform detailed ground truth surveys. Ground truthing studies were conducted to determine or verify habitat classifications identified from photographs. Plant communities were also characterized by prevalent species associations.
3. Digitized mapped habitats. Mapped habitats were digitized for use on a GIS system. Data sets developed were compatible with ARC/INFO.

Segmentation of Galveston Bay

Funding:	\$25,000
Performing Organization:	Jones and Neuse, Inc.
Principal Investigator:	James Patek
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Resource Management Issues

Characterization studies, eventual management activities under the CCMP, and design of an effective monitoring program all are served by segmentation (subdivision) of the estuary into smaller units. This project determined a rationale for segmentation based on physico-chemical, hydrologic, biological, and geo-political considerations in relation to estuarine management. Consideration was given to cell geometry in current modeling efforts by the Texas Water Development Board, U.S. Army Corps of Engineers, and Texas A&M University. The project recommended an appropriate scale (segment size) to enable increased resolution compared to current segmenting schemes. A primary benefit of segmentation will be for future monitoring of the Bay. The final product of this project is a published report to be utilized in drafting the CCMP.

Accomplishments:

1. A survey was conducted of existing segmentation schemes used by various state and federal agencies in Galveston Bay. Segmentation information from Guidelines for Clean Water Act (CWA) Segmentation, and segmentation activities from other National Estuary Programs were utilized.
2. Natural features and anthropogenic influences were determined. The entire estuary was reviewed for natural boundaries in physico-chemical features and within-bay circulation and biology including fishery resources. Information included influences on water quality, habitat, and geomorphology.
3. Segmentation criteria were determined based on the above information. Criteria were drafted to segment Galveston Bay into geographical units producing the greatest possible number of end uses for future Bay management by resource entities, including monitoring of water quality, habitat, and living resources.
4. Drafting Boundaries. Segments were mapped based upon an integration of results determined for objectives 1-3, above, and based on coordination with the Management Committee of the GBNEP.

Point Source Loading Characterization

Funding:	\$60,000
Performing Organization:	University of Texas
Principal Investigator:	Dr. Neal Armstrong; Dr. George Ward
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Reduction/Alteration Living Res.; Public Health

Estimates were made for pollutant loadings to the estuary from major tributaries and permitted point source wastewater discharges. Parameters included were selected nutrients and toxic elements and compounds. The primary sources of information were: 1. Texas Water Commission permit criteria, compliance monitoring data, permittee self-reporting data, and

waste-load evaluation studies; 2. Texas Railroad Commission permit criteria and permittee self-reported data (for oil field produced water discharges), along with existing data from special studies concerning average produced water constituent concentrations; and 3. Texas Water Commission and other available ambient monitoring data (for tributaries). Results of the study constitute a cumulative loading study of permitted pollutant loading for the bay system.

Accomplishments:

1. Long-term point source loadings data were compiled from various state and federal agencies as well as other applicable sources.
2. Historical and existing quality control systems were assessed, including sampling methodology, and determinations were made regarding the reliability of data sets based on these assessments. Gaps were identified in existing data which impede adequate appraisal of water/sediment quality. Problems with existing monitoring methodology (both in laboratory and field) were documented which impede the use of monitoring data for trend analyses.
3. Existing permitted point source loading and historical trends in the Galveston Bay complex were described from reliable historical data, utilizing graphical displays, statistical time series analysis, and descriptive statistics (e.g., ANOVA, means, ranges, etc.). These assessments were conducted for each Texas Water Quality Segment within the Galveston Bay watershed below Lake Livingston and Lake Houston. Comparisons between segments were made to determine spatial trends.
4. Existing loadings were compared to regulatory criteria/standards and waste load allocations (where present) for each segment and potential problem areas were identified. A cumulative loading assessment of permitted pollutant loading to the Bay system was completed, and recommendations were made.

Non-Point Source Characterization

Funding:	\$125,000
Performing Organization:	Groundwater Services, Inc.
Principal Investigator:	Charles Newell
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Reduction/Alteration Living Res.; Public Health

This project was created to determine non-point source pollutant loadings to Galveston Bay from storm water runoff, emphasizing urban runoff. The problem of non-point runoff is one of the greatest future challenges to effective management of Galveston Bay. Chesapeake Bay studies indicate Washington D.C. runoff alone contributes conservatively up to 5 million gallons of oil and grease per year to the Chesapeake, or, on the order of half the volume of the Exxon Valdez spill each year. The Houston urban area, being larger and more industrialized, may have a greater impact on its smaller estuary. Because the problem is massive and diffuse, simple

solutions do not exist. This project takes a Geographic Information System (GIS) approach to this difficult problem. The surrounding watershed is divided into subwatersheds and loadings for pollutants and determined for each subwatershed. Overall loadings are ranked according to this geographic approach, so sources of pollutants may be targeted for management actions. A final report and atlas of maps are the final result of this project.

Accomplishments:

1. Literature and data were reviewed. The review encompassed non-point source information potentially having a bearing on the study area: that portion of the Galveston Bay watershed downstream of Lakes Houston and Livingston.
2. A geographic analysis was conducted on non-point sources. The analysis was conducted to create maps and geographic information system overlays for watershed hydrology, and land use related to NPS sources and impacts. The effort included estimates of NPS loading by land use types and NPS parameter categories, a ranking of subwatersheds based on NPS loadings, and a determination of possible influences of the upper watershed outside the main study area.
3. A final report and accompanying atlas of maps was produced for use in drafting the CCMP.

Ambient Water/Sediment Quality Characterization

Funding:	\$100,000
Performing Organization:	University of Texas
Principal Investigator:	Dr. George Ward Dr. Neal Armstrong
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Reduction/Alteration Living Res.; Public Health

Objectives were to characterize the existing water and sediment quality in the Galveston Bay complex, and to identify trends based on a graphical and statistical time series treatment of existing data. Work screened existing data sets and reports for applicability and reliability prior to analyses. Results were then compared to existing criteria, standards, and designated uses. Problem areas were identified, as were information gaps preventing effective appraisal of ambient water and sediment quality. Work was coordinated with the point and non-point source loading investigations (above) to yield recommendations for future management under the CCMP, and future monitoring approaches that can measure water and sediment improvements. The final result of this project is a published report.

Accomplishments:

1. Long-term water and sediment quality data from various state and federal agencies were compiled.

2. Historical and existing quality control measures were assessed and reliability of data sets were determined. Gaps in existing data were identified which impede adequate appraisal of water/sediment quality. Problems were identified for existing monitoring methodology (both in laboratory and field) which impede the use of monitoring data for trend analyses.
3. Existing water/sediment quality was described and historical trends in the Galveston Bay complex were noted utilizing graphical displays, statistical time series analysis, and descriptive statistics. These assessments were conducted for each Texas Water Quality Segment within the Galveston Bay watershed below Lake Livingston and Lake Houston.
4. Existing water quality was compared to regulatory criteria/standards for each segment and problem areas were identified.
5. General circulation patterns and flushing rates for the Galveston Bay system were recognized and probable mechanisms for observed spatial and temporal patterns in water/sediment quality parameters were described.
6. A final report was drafted for GBNEP review and publication.

Living Resource Characterization

Funding:	\$125,000
Performing Organization:	Texas Parks and Wildlife Dept.
Principal Investigator:	Al Green
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Reduction/Alteration Living Resources

The objective was to determine status and trends in populations of ecologically or economically significant organisms in Galveston Bay. Species were chosen for which historical (i.e., fishery) data sets exist, or which are critical in the food web. Species included penaeid shrimp, speckled trout, red drum, flounder, and blue crab. Secondary consideration was given to forage fish species, phytoplankton, birds, and benthic organisms. (Seagrasses, salt marsh species, and oysters were considered in other projects). Multivariate and time series analyses were applied to data sets, with correlations sought between identified trends and possible controlling variables imposed by human impacts on the Bay. Critical missing information was identified for future work.

Accomplishments:

1. Data bases were selected for analyses. Data bases containing living resource information pertinent to Galveston Bay were reviewed as part of the selection process.
2. Selected data bases were analyzed. Appropriate data bases identified were analyzed to determine trends in temporal abundance of the selected species.
3. Studies were identified and described that would permit definitive conclusions on patterns of change in the Galveston Bay ecosystem. Recommendations were made for modifications

in sampling and monitoring activities which would provide improvement of analyses for detecting temporal changes in the bay ecosystem.

Socioeconomics of Galveston Bay Utilization

Funding:	\$50,000
Performing Organization:	University of Houston-Clear Lake
Principal Investigator:	Dr. Roger Durand
GBNEP Project Coordinator:	Russell W. Kiesling
Priority Problem:	Resource Management Issues

The socioeconomics of Galveston Bay utilization was characterized, including recreational fishing, boating, shipping, wastewater receiving, commercial fishing, land values, oil and gas production, and others. Direct and indirect dollar estimates were determined for activities based upon best available existing data. Resource values were estimated for some specific uses, for example value of salt marsh productivity; value of trawl by-catch mortality; value of shellfish lost to harvest due to closures. Influences of Galveston Bay on selected segments of the local community were investigated.

Accomplishments:

1. Using the latest available census tracts, demographic trends which affect bay use such as urban-rural population shifts, family income, type of employment and ethnic composition were characterized for the four counties surrounding the bay.
2. User groups were identified e.g. commercial fishermen; recreational boaters; conservationists; industry employees etc. These groups were characterized by: (1) the nature of the dependence of these groups on the bay system and (2) the inter-relationships (inter-dependence and competition) between the different groups.
3. Social trends which affect bay resources were identified. Such trends include bay related employment (such as decline in traditional occupations and introduction of new ones); tourism; boating; shipping; development, agriculture, etc.
4. Economic values of Bay Activities were determined through the collection and synthesis of existing data on economic value of the following bay system related activities: shipping, oil and gas drilling and leasing, wastewater treatment, commercial and recreational fishing, agriculture, realty (land use/values), navigation, manufacturing, recreational boating, tourism and other users identified in the course of this project.
5. The final report will codify and synthesize the above information for use by the conference to (a) predict future trends in bay use and (b) predict potential impact of a CCMP on the surrounding communities and other user groups. It will also identify gaps in information and include recommendations for additional research pertaining to the social and economic importance of the Galveston Bay system to its surrounding communities.

Public Participation

In FY 1991, Public Participation activities were undertaken both through Program Office projects and outside contracts. Projects described below were conceived to meet three overall objectives: determination of citizen concerns and perceptions related to Galveston Bay; public education and awareness concerning the function and importance of the estuary; and direct involvement of citizens in determining estuarine management. In addition to the projects summarized, the Galveston Bay Information Center (above) was conceived to be a benefit to the public.

BayLine Newsletter

Funding:	\$10,000
Performing Organization:	Program Office
GBNEP Project Coordinator:	Kevin Hamby
Priority Problem:	All, depending on topic

The GBNEP newsletter continued to be produced on a quarterly basis. BayLine is produced by the staff, with articles contributed by a variety of organizations and individuals in the Bay area. BayLine includes: Management Conference updates, NEP news, requests for public involvement, and information on specific issues that affect the estuary. BayLine has continued to utilize the "theme" approach of highlighting a relevant Bay topic in each issue.

Publication Series

Funding:	\$54,800
Performing Organization:	Program Office
Principal Investigator:	none
Project Coordinator:	Kevin Hamby
Priority Problem:	All, depending on topic

The results of most GBNEP projects have continued to be published in a special series and have been made available to conference members and the public (Table 1). Publications included technical and scientific reports, planning documents, membership directories, and results of GBNEP work.

Education

Funding:	\$25,000
Performing Organization:	Program Office
Principal Investigator:	Marie Nelson
Project Coordinator:	Kevin Hamby
Priority Problem:	Public Health; Resource Mgmt. Issues

The Education Subcommittee of the CASC initiated several projects for students, including: 1. Water Education Teams (WETs) - groups of students complete a series of water quality tests in the Bay Area to learn about man's activities and impact on the local environment from a problem-solving perspective; 2. Calendar Contests - students submit Bay-related art work for selection for publications like calendars, posters, and coloring books; 3. Science Fairs - the GBNEP sponsored special environmental categories and awards for Bay-related projects.

Video Production

Funding:	\$12,000
Performing Organization:	not awarded
Principal Investigator:	not awarded
Project Coordinator:	Kevin Hamby
Priority Problem:	Resource Management Issues

A short video presentation was produced to inform the public concerning the uniqueness of the Bay system; the importance of conserving the Bay; the need to become involved in the Bay's future; and the purpose of the GBNEP. Serving an educational purpose, the video will be used in classrooms to supplement the Speaker's Bureau program, as a resource for persons requesting information about the Bay and the Program. The video was also designed to be viewed with the Educational Display (below) at meetings and expositions.

Table 2.

Publications List

Galveston Bay National Estuary Program

Revised August 5, 1990

<u>Publication Title</u>	<u>Date</u>	<u>Number</u>	<u>Status</u>
BayLine (Program Newsletter)			
1. Program Overview	Apr. 1989	--	Out of Print
2. Galveston Bay: an Economic Resource	Jul. 1989	--	Available
3. Coastal Preserves	Nov. 1989	--	Out of Print
4. Non-Point Source Pollution	Mar. 1990	--	Available
5. Attacking Bay Problems; Project Summary	Aug. 1990	--	Available
6. Estuary Programs: A National Perspective	Oct. 1990	--	Available
7. Bay Day	Apr. 1991	--	Available
8. Science in Bay Management	Aug. 1991	--	Available
Report Publication Series			
EPA/State Management Conference Agreement (Five-year Basis for the GBNEP)	Oct. 1989	GBNEP - 1	Available
Fiscal Year 1990 Workplan	Oct. 1989	GBNEP - 2	Available
Member Directory	Oct. 1989	GBNEP - 3	Out of Print
Member Directory	Aug. 1990	GBNEP - 4	Available
Fiscal Year 1991 Workplan	Aug. 1990	GBNEP - 5	Available
Proceedings: Galveston Bay Characterization Workshop, February 21-23, 1991	Feb. 1991	GBNEP - 6	Available
An Environmental Inventory of the Christmas Bay Coastal Preserve	Mar. 1991	GBNEP - 7	Available
An Environmental Inventory of the Armand Bayou Coastal Preserve	Mar. 1991	GBNEP - 8	Available
Regulatory Survey for the Christmas Bay Coastal Preserve	Mar. 1991	GBNEP - 9	Available
Regulatory Survey for the Armand Bayou Coastal Preserve	Mar. 1991	GBNEP - 10	Available
Fiscal Year 1992 Workplan	Aug. 1991	GBNEP - 11	Avialable
Shoreline Survey for Unpermitted Discharges to Galveston Bay	Aug. 1991	GBNEP - 12	Avialable

Special Publications

Galveston Bay National Estuary Program

(Brochure)	Dec. 1989	--	Available
Galveston Bay, A Home (Brochure)	Mar. 1990	--	Available
What Galveston Bay Means to Me (Fourth Grade Art Calendar, 1991)	Oct. 1990	--	Available
Galveston Bay Recreational User's Handbook	May 1991	--	Available
Protection Through Education (Brochure)	July 1991	--	Available
Household Tips - Protecting Galveston Bay (Handbook for Non-Point Source Reduction)	August 1991	--	Available

Videos

Balancing Act (Christmas Bay, Armand Bayou, and Roles in Bay Conservation)	Oct. 1990	--	Released
Public Service Announcement: "Don't Get Dumped On"	Oct. 1990	--	Released
Oil Spills: Marine Resources at Risk (in cooperation with TWC)	April 1991	--	Released
GBNEP Promotional Video	July 1991	--	Released
Conflicting Uses of Galveston Bay	August 1991	--	
Oyster Harvesting and Conservation in Galveston Bay	August 1991	--	
Understanding the Galveston Bay Ecosystem	August 1991	--	

Most publications are available free of charge while supplies last. Videos may be viewed at the Galveston Bay Information Center, Jack K. Williams Library, Texas A&M University at Galveston, and are distributed on a limited basis. For copies of publications or information about videos or other projects, contact:

Galveston Bay National Estuary Program

Bay Plaza I
711 Bay Area Boulevard
Suite 210
Webster, Texas 77598

Phone: (713) 332-9937

Video Public Service Announcement

Funding:	\$7,500
Performing Organization:	TWC
Principal Investigator:	N/A
Project Coordinator:	Kevin Hamby
Priority Problem:	Resource Management Issues

Video PSAs produced in FY 1990 were followed up with one more in FY 1991. The aim was to reach the general public at its most general, least informed level.

Portable Educational Display

Funding:	\$2,000
Performing Organization:	Program Office
Principal Investigator:	none
Project Coordinator:	Kevin Hamby
Priority Problem:	All; depends on topic

A display backboard and supplementary materials were acquired in FY 1990 for large audience education at various trade shows, festivals, and other exhibits. In FY 1991, this project provided for display maintenance (to keep display information current), transportation, and exhibit fees.

Speaker's Bureau

Funding:	\$2,000
Performing Organization:	Program Office
Principal Investigator:	none
Project Coordinator:	Kevin Hamby
Priority Problem:	All; depends on topic

Management Conference volunteers and program staff continued to provide programs for interested organizations in the Houston/Galveston area using the Speaker's Bureau to fill requests for presentations. The Bureau was coordinated from the Program Office, with slide presentations, video materials, publications, and equipment made available to the volunteer speakers.

Citizen's Monitoring Plan

Funding:	\$25,000
Performing Organization:	Texas Water Commission
Principal Investigator:	Catherine Albrecht
Project Coordinator:	Kevin Hamby
Priority Problem:	Resource Management Issues

Citizens from the Bay area had the opportunity to directly support Galveston Bay management through this plan. The Citizen's Monitoring Plan, drafted under the FY 1990 portion of this project, involved a Citizen's Monitoring Committee to coordinate with the Texas Water Commission to begin volunteer citizen field monitoring of water quality and other estuary conditions. The FY 1991 portion of this project involved implementation of this plan. Data is being gathered to supplement the existing monitoring data collected by agencies, expanding the amount of information available to managers. Armand Bayou was selected in FY 1990 as a pilot project for this effort. Citizen monitoring is seen as a significant component of community involvement in the welfare of the estuary, and this project will expand in future years.

Public Meetings

Funding	\$15,000
Performing Organization:	Program Office
Project Coordinator:	Kevin Hamby
Priority Problem:	Resource Management Issues

Galveston Bay Public Forum meetings continued to support interaction between Program participants and the public. Comments received at these meetings were used to help direct all aspects of the Program. These meetings were held in Galveston, Central Houston, Clear Lake and Baytown. Three sets of meetings were held on Coastal Preserves, Oil Spill Concerns and Citizen's Monitoring. Over 125 people attended each series of meetings.

Bay Day

Funding:	\$25,000
Performing Organization:	Galveston Bay Foundation
Principal Investigator:	Bay Day Steering Committee
Project Coordinator:	Kevin Hamby
Priority Problem:	Resource Management Issues

This springtime event was the first of what is hoped to become an annual event for citizens in the Houston-Galveston area. Bay Day was conceived as a festival in celebration of the Bay, as well as a means for highlighting the significance of the estuary and need for wise use. Plans called for a consultant for ten months, with support by a Steering Committee, Social Committee, Finance Committee, and Volunteer Committee. A GBNEP staff member committed 10 percent time to the event in the first year; ultimately the goal is for a growing, self-sufficient event management group.

Pollution Reporting Hotline

Funding:	\$ 45,000
Performing Organizations:	not awarded
Principal Investigators:	Galveston Bay Foundation
Project Coordinator:	Kevin Hamby
Priority Problem:	All; depends on topic

The Pollution Reporting Hotline developed out of Management Conference discussion concerning who to list as an official contact in public service announcements discouraging pollution. The Policy Committee requested that the Management Conference develop a system that would enable the average citizen to easily report pollution violations. The CASC proposed to develop a workscope that would develop a communications tree and a coordinated package for publicizing the hotline. This project was not in the original workplan for FY 1991, but is an example of flexibility in plans required for an effective response to changing needs. The project was funded with funds originally earmarked for a Public Information and Education project, determined by legal review to be non-procurable under Texas law.

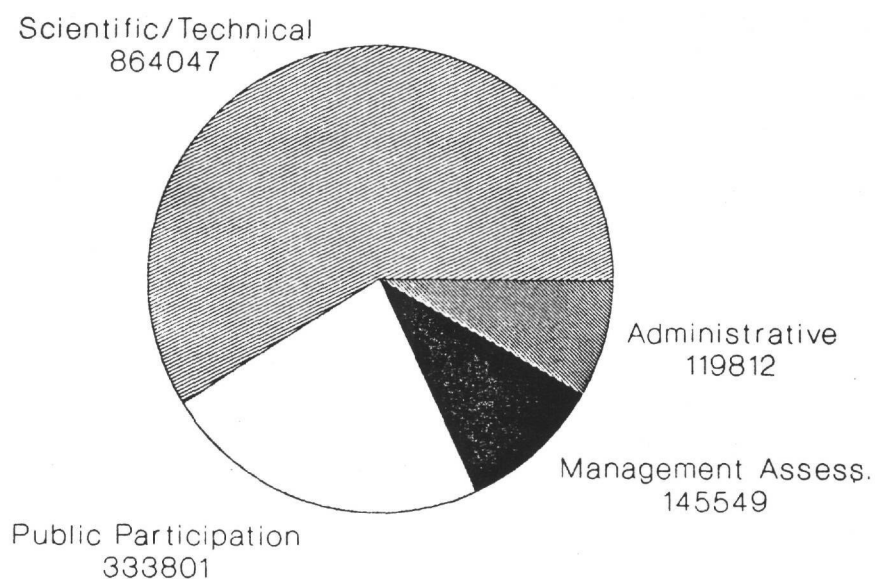
Table 3. Galveston Bay National Estuary Program Fiscal Year 1991 Budget

Program Element and Total Budget	Category	Budget
Management Assessments \$145,549	Salary Indirect Fringe Travel Capital Supplies Other Contracts	34,170 18,578 8,050 4,250 0 1,250 1,500 77,750
Scientific/ Technical \$864,047	Salary Indirect Fringe Travel Capital Supplies Other Contracts	47,472 25,811 11,184 6,750 300 4,250 1,000 767,280
Public Participation \$333,801	Salary Indirect Fringe Travel Capital Supplies Other Contracts	60,024 32,635 14,142 9,000 0 2,750 165,250 50,000
Administrative \$119,812	Salary Indirect Fringe Travel Capital Supplies Other Contracts	47,610 25,886 11,217 5,000 2,250 1,250 2,600 24,000
Action Demo	Contracts	130,000
Program Total		1,593,209

Figure 2. GBNEP FY 1991 Budget By Work Element and by Budget Category Pie Charts

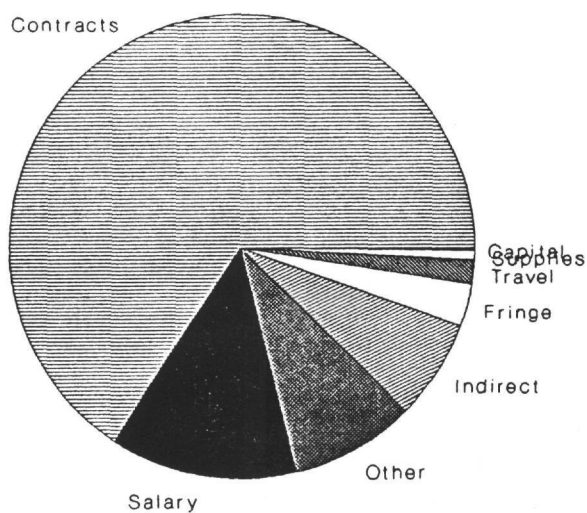
GBNEP FY 1991 BUDGET BY WORK ELEMENT

Revised April 26, 1990



GBNEP FY 1991 BUDGET BY BUDGET CATEGORY

Revised April 26, 1990



Program Activities for Fiscal Year 1992

Work to be undertaken by the GBNEP in FY 1992 falls into five key program areas:

1. Management Assessments. This element reflects primarily "Program Inventory" and "Base Programs Action Plan" items in guidance provided by the EPA Office of Marine and Estuarine Protection. The approach to this element in FY 1992 will involve a Bay-wide Management Evaluation that will eventually contribute directly to drafting of the CCMP. This evaluation will be expanded from the completed regulatory evaluation project concerning the two designated State Coastal Preserves, Christmas Bay and Armand Bayou. Management Assessments will ultimately determine "how" we manage the estuary; whereas the Scientific/Technical Assessments, below, will determine "what" we need to manage. The results of this work will be published as a "Framework for Action," which, combined with the Environmental Characterization Report (below) will be the basis of the CCMP.

2. Scientific/Technical Assessments. This element reflects primarily the "Characterization" guidance item in the Management Conference Agreement. Critical existing historical data will be evaluated for environmental trends and to determine causes of Priority Problems, and new studies will be initiated where gaps exist in historical data. Study goals will target four broad categories corresponding to Priority Problems: Reduction/Alteration of Living Resources; Public Health Issues; Resource Management Issues; and Shoreline Erosion. The emphasis on scientific/technical projects in the coming year will be on determining probable causes for observed trends, and systematically compiling synoptic information from the numerous studies--information that will be of direct use to managers. The results of this work will contribute to the Environmental Characterization Report which, with the results of the Management Assessments, will be the basis of the CCMP.

3. Public Participation. Public participation is a key element in consensus-building. Citizen educational and involvement activities will maintain continuity with programs begun over the last two years. Components include publication of the newsletter, convening of public meetings, slide and video presentations, and special events. A Five-year Public Participation Plan drafted in FY 1990, as well as the specific activities listed in Part III of this document provide a detailed planning perspective for this program area.

4. Program Administration. A Program Director and support staff will continue to guide the GBNEP toward the goals of the Management Conference. Roles of the Program Office include staff support of committees, program planning, project contract procurement and coordination, interagency coordination and communication, and administrative coordination with EPA. These activities have been refined throughout the first two years of the program. The projected budget details an administrative component for each of the three other key program areas, above, as well as for this program-wide component.

5. Action Plan Demonstration Projects. In FY 1990 and FY 1991, funds were sought and received from the EPA for Action Plan Demonstration Projects. These projects are designed to initiate early actions in management implementation of the sort that will eventually be implemented Bay-wide under the CCMP. In 1990, a two year project was funded which successfully created two new Texas Coastal Preserves for Christmas Bay and Armand Bayou.

Creation of the preserves involved environmental and management assessments and drafting of a Management Plan. In 1991, a project was implemented to restore fringing salt marsh habitat for living resource benefits and erosion protection. This project involved the planting of smooth chord grass, *Spartina alterniflora*, in selected areas. In FY 1992, a project was proposed and approved to reduce toxicity in the Houston Ship Channel by working cooperatively with the industries having the greatest potential contributions to this problem. This project is further described in Appendix I of this report.

Looking at the program as a whole, our thrust in the coming year will involve a wrapping up of the most significant characterization studies in the form of final project reports, and a pooling of results from these different projects into ecosystem-level syntheses that emphasize probable causes. This compilation of characterization results in the form of synoptic information in the Environmental Characterization Report will take place throughout the year, even though the final publication release will not occur until FY 1993. The goal of this activity is creation of an information base that is useful for drafting action plans. In pursuit of this goal, the GBNEP has chosen to increase staffing at the Program Office, rather than utilizing outside contracts. Members of the Management Conference felt Program Office staff were in the best position to synthesize characterization results, by virtue of having coordinated projects since the Program began.

Beyond characterization, the Program will be in a transition between information-gathering activities and action-planning activities. In the coming year, Management Conference members will begin the conceptual jump from studying the problems of Galveston Bay, to setting very explicit goals for a series of action plans that will eventually evolve into the CCMP. In other words, we will begin drafting the CCMP long before year five. Starting early has several benefits. We will face the challenge of setting explicit goals and proposing explicit actions in a context of incomplete information--a context certain to remain even at the end of the program. "Getting down to brass tacks" early will give us time to deal with controversies that are sure to arise as planning and information gathering are translated into action.